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ABSTRACT

An innovative curriculum called the "Regional Center Alternative Pathway," recently adopted by the Northwest Center for Medical Education (part of Indiana University's School of Medicine), is presented. The curriculum combines the traditional structure's didactic approach with a new problem-based tutorial curriculum. In this curriculum the emphasis is on the medical students' acquisition of the necessary knowledge, attitudes, and skills of a lifelong learner. The academic program of the new curriculum, which integrates the traditional first- and second-year content into eight steps, is outlined. Other features of the new curriculum include: problem-based tutorial sessions, a minimum of lectures, and doctor/patient interaction. A 13-item list of selected references also is included. (DB)

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# A PROBLEM SOLVING CURRICULUM FOR ACTIVE LEARNING AT THE NORTHWEST CENTER FOR MEDICAL EDUCATION INDIANA UNIVERSITY SCHOOL OF MEDICINE

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# A PROBLEM SOLVING CURRICULUM FOR ACTIVE LEARNING AT THE NORTHWEST CENTER FOR MEDICAL EDUCATION INDIANA UNIVERSITY SCHOOL OF MEDICINE

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## A. BACKGROUND INFORMATION OF THE NEW PATHWAY CURRICULUM

Medical education has evolved through the centuries from a transfer of medical knowledge and skills at a personal level, the ***apprenticeship*** form, to a more ***structured*** approach (1). Hippocrates, in addition to the personal interaction used also the method of discourse (dialectic) reinforced medical education. In the 17th and 18th centuries two types of medical education developed: (a) the ***clinical*** type of medical schools which originated in France and England and continued the apprenticeship form of medical education in a hospital setting, and (b) the ***university*** type of medical schools which originated in Germany and spread to England, Scandinavia and Helvetia (1). In the university type, well trained faculty in basic sciences were the teachers and the different basic science ***disciplines*** originated.

In 1910 the **Flexner** report adopted a more structured medical education in the United State. Since then extensive discussions regarding medical education resulted in some changes in the curriculum in a number of medical schools. The key question, however, which remains unanswered is ***"how do medical students learn?"*** (2). Kenneth R. Cox and Christine E. Ewan (2) indicated that (a) relevance, (b) appropriate sequence of instruction, (c) active student involvement in learning, and (d) adequate feedback on performance are some principles of learning. Engel and Clarke (3), studying the approach of the medical school at the University of New Castle and McMaster University Medical School suggested that the solution to the problem is to ***rearrange the subject matter by presenting a series of real problems which the students must actively engage.***

In 1969 McMaster Medical School in Hamilton, Ontario, Canada, adopted a radical position regarding medical education (6,7,9). It was suggested that lectures did not provide a contemporary learning environment and that the basic sciences were not an ***"obligatory antecedent to clinical studies"*** (6). It was felt that medical education could be improved by introducing ***biomedical*** and ***clinical*** problems to medical students from the first day in medical school and that learning is ***"problem based"*** and not ***"discipline"*** or ***"subject"*** based (6). In promoting a better atmosphere for discussion and learning, McMaster Medical School introduced, instead of lectures, the ***"small group"*** of five to six students, for ***"small group learning"*** in the presence of a ***tutor*** who does not control the discussion of the group but rather serves as a ***"shepherd"*** (6) or coach. The current curriculum at McMaster consists of ***six units***, which are a series of interdisciplinary blocks and includes the final year of clinical clerkship rotations. It is expected that in this curriculum the medical students will develop ***independent, lifelong*** learning skills (7) through problem-based learning methods (6,7). This curriculum is offered to the whole class of one hundred students who matriculate at McMaster Medical School each academic year (7).

At the University of New Mexico School of Medicine a small group of faculty from both the clinical and basic science departments served as a planning committee and in 1977 proposed an experimental medical school curriculum (8,9). The goal of the proposed curriculum was to develop ***self-directed*** physicians with ***lifelong*** learning skills, who would seek a career in primary care in a rural area. This new curriculum was called ***Primary Care Curriculum (PCC)*** and in 1979 the first group of ten students began a pilot program (8,9,10). The PCC program borrowed liberally from the "small group", and the "problem-based learning program" of McMaster Medical School (8,9), and from the "rural-based education program" of Michigan State University's Upper Peninsula. As in the McMaster program the PCC program offers no lectures and the students learn in small tutorial groups of five with a faculty facilitator or tutor (8,10). The subject material of the first two years of medical school was rearranged in ***seven units***, three in the first year and four in the second. At the present twenty medical students are assigned to this pilot program.

In 1982 Dean Daniel C. Tosteson appointed a committee to study the development of an innovative curriculum for medical students at Harvard Medical School (5). At this committee's recommendation, Harvard Medical School introduced the ***"New Pathway"*** and twenty-three volunteer students matriculated in the new curriculum. This program is characterized by equal emphasis on ***attitudes, skills*** and ***knowledge*** (5). The core of this program is the use of ***problem-based*** discussions and independent study. This is achieved by small groups of eight students who discuss a case

problem with a faculty tutor similar to the McMaster program. The first and second year content is rearranged in ***six sequential blocks***. In contrast to the McMaster and the New Mexico programs the New Pathway program offers a set of ***lectures, laboratories*** and ***conferences***, which are designed to reinforce the small group tutorial sessions. Furthermore, the student evaluation includes a small number of ***written exams*** in addition to the tutorial evaluation.

In 1984 the report of the Panel on the General Professional Education of the Physician and College Preparation for Medicine, known as **GPEP** report, studying the results of problem-based curricula, indicated in "Conclusion 3, Recommendation 4" that "***Medical faculties should offer educational experiences that require students to be active learners and problem solvers, rather than passive recipients of information"*** (4). In the same report (Conclusion 1, Recommendation 1) it is stated that "*.....**medical faculties should emphasize the acquisition and development of skills, values, and attitudes by students at least to the same extent that they do their acquisition of knowledge....***" (4).

At the present there are a number of medical schools around the world which initiated innovative problem-based curricula (11) such as: Michigan State University (12); Rush Medical College; University of New Mexico School of Medicine (8); Harvard University Medical School (5); Bowman Gray School of Medicine of Wake Forest University (13); Mercer University School of Medicine; Tufts University School of Medicine and McMaster University School of Medicine (6), also the National Autonomous University of Mexico, the Shanghai Second Medical University, the University of Philippines, the Sub Yat-sen University of Medical Sciences, Guangzhow, People's Republic of China (12), and the Christian Medical College in Ludhiana, India.

At Indiana University School of Medicine and specifically at the Northwest Center for Medical Education, Gary, Indiana, Dr. Panayotis G. Iatridis, the Director of the program, felt that during the last five years the freshman and sophomore medical students were experiencing a pressure of informational overload and that their goal was not to synthesize the learned material and to solve problems, but rather to study in order to ***pass an exam***. The question often asked by students was "***what do I have to know in order to pass an exam?"*** rather than "***what do I have to know to become a competent and caring physician?"*** They argued constantly that certain exam questions ***did not reflect their handouts*** and argued extensively that their ***questions were unfair.*** This problem does not seem unique to the Northwest Center. Dr. A. Kaufman (11) states in a recent publication that a teacher feels energized by an eager student asking ***"How does hyperuricemia cause an inflamed joint like the one I saw in clinic yesterday?*** " but drained by a student asking ***"Do I have to learn about purine metabolism for the upcoming biochemistry midterm examination?"*** (11).

The Director of the Northwest Center discussed his concerns with Dean Walter J. Daly, M.D. and with the Dean's encouragement and support initiated a discussion among the Center faculty. On May 9, 1989 three senior Northwest faculty, Drs. Hoftiezer, Baldwin and Bankston accompanied Dr. Iatridis on a visit to Harvard Medical School. On June 20, 1989, Drs. Vanden Berge, Hoftiezer, Echtenkamp and Dr. Iatridis visited McMaster University Medical School. It became apparent from these visits and from the study of the available literature, that there are two extreme positions regarding medical education: (a) the **traditional** programs, which are totally structured and completely faculty-directed curricula; and (b) the **problem-based learning** programs, which are student-directed curricula. The former are the post Flexner report programs now offered in the great majority of the medical schools in the United States and Canada and are characterized by structured lectures, laboratories and a number of objective type of exams. The latter are similar to the McMaster Medical School curriculum and characterized by problem-based tutorial learning sessions in small groups of students, no lectures, no laboratories and no formal exams.

After extensive discussion, the faculty of the Northwest Center for Medical Education adopted an innovative curriculum which is a **combination** of the **old** (traditional) and the **new** problem-based tutorial curriculum. This is called the **"Regional Center lternative Pathway"** and is a modification of the Harvard Medical School's "New Pathway" program. The Regional Center Alternative Pathway will introduce the problem-based tutorial sessions in addition to a few basic lectures and laboratories. The subject matter on the other hand has been rearranged into **8 steps** which are presented sequentially. In this curriculum the emphasis is on the medical students acquiring the necessary knowledge and developing the right attitude and skills of a lifelong learner.

## B. GENERAL AND SPECIFIC OBJECTIVES OF THE NEW PATHWAY

The general objectives of the "**Regionmal Center Alternative Pathway'** are: (a) to develop new and innovative educational programs based on **reorganization** of the first and second year medical educational material available; (b) to assist the freshman and sophomore medical students to acquire and apply the necessary **knowledge** through small group interactive **problem-based learning sessions**, basic lectures, laboratories and other learning assisting methods, to promote the right **attitudes** which will lead to the appropriate behavior, and to develop the necessary **skills** for the practice of medicine; and (c) to assist the faculty of the Northwest Center to develop **tutorial** skills and to adapt their teaching and service responsibilities to the needs of the new curriculum.

Specifically in the**"Regional Center Alternative Pathway"** every medical student is expected to work towards the domains of learning which will ultimately lead to the acquisition of the necessary knowledge and to the development of the appropriate skills and attitudes that will become a part of continued and lifelong professional growth. It is expected that this pathway will insure that the graduates of medical school will become **lifelong learners.**

Furthermore, the "**Regional Center Alternative Pathway"** curriculum is designed to foster desired physician characteristics by achieving a balance between knowledge, skills and attitude learning. As a result of the implementation of the new curriculum, students are expected to:

### I. KNOWLEDGE

1. Acquire basic knowledge of core curriculum which will serve as a foundation for continuing study.
2. Apply basic science knowledge to problem-solving and clinical situations.
3. Acquire current content and procedural knowledge in their area of practice.
4. Integrate biological, social and behavioral knowledge in practice.
5. Acquire current knowledge of medical-ethical and legal issues.
6. Maintain an awareness of socio-economic issues which impact the physician's practice.
7. Consider life-style implications when treating patients.

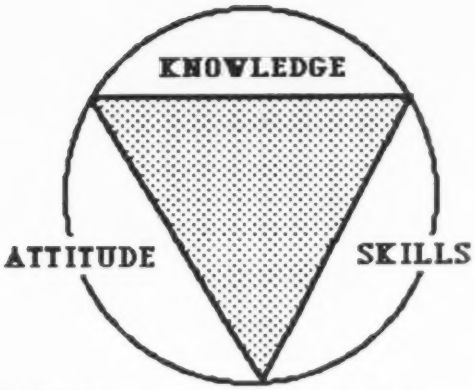
### II. SKILLS

1. Acquire, organize and apply information.
2. Communicate effectively with patients and their families to acquire and disseminate information.
3. Perform basic diagnostic and therapeutic procedures.
4. Request appropriate ancillary diagnostic procedures.
5. Perform or request non-invasive or invasive therapeutic procedures.
6. Communicate effectively in writing and in oral interactions.
7. Work effectively with one's colleagues and health care systems.
8. Problem-solve in a clinical situation.
9. Perform self-evaluation, identify deficiencies and take appropriate action to correct deficiencies.

### III. ATTITUDES

1. Show empathy toward patients.
2. Appreciate patient differences in cultural values and socio-economic levels.
3. Appreciate the necessity for life-long learning.
4. Appreciate the value of self-evaluation.
5. Develop collegial working relationships with health care professionals.

The acquisition of knowledge and the development of skills and attitudes are interdependent. An appropriate attitude and learner's skills are required for the acquisition of the necessary knowledge, whereas a certain degree of knowledge and a right attitude are needed in order for the appropriate skills to be developed. Diagrammatically this concept can be expressed as follows:




## C. ACADEMIC PROGRAMS OF THE NEW CURRICULUM

In the past 18 years, the Northwest Center for Medical Education has offered a traditional first and second year medical curriculum. During the 1990-1991 academic year the Northwest Center, responding to a national trend, will implement an innovative curriculum based on **problem solving** and **active learning.** The new **"Regional Center Alternative Pathway"** is a modification of existing progressive curricula now available in a number of medical schools around the country, and is characterized by:

I. An integration of traditional first and second year content into **8 steps**, or curricular units, which will be presented sequentially during the first two years of medical school. Although the different steps reflect in general the traditional basic science disciplines, the problem-based learning sessions will provide horizontal correlation across disciplines while (a) retaining and enhancing, in the first year the essential fund of knowledge in basic sciences and (b) emphasizing in the second year, and in particular in Step 8, a more clinical approach. The **8 Steps** of the new curriculum are:

**1st Year**

| | | |
|---|---|---|
| **Step 1** | The Molecular Basis of Medicine (Biochemistry) | 6 weeks |
| **Step 2** | Human Structure (Gross Anatomy, Radiology, Histology, Cell Biology) | 11 weeks |
| **Step 3** | Systemic Function and Drug Action (Physiology, Pharmacology) | 9 weeks |
| **Step 4** | Neural Control and Disease (Neurosciences and Neuropharmacology) | 7 weeks |
| **Step 5** | Ambulatory Medicine (Basic Clinical Experience) **(OPTIONAL)*** | 4 weeks |

* Step 5 is **Optional** but highly recommended. In this step the interested students, at the end of their freshman year, are assigned to a primary care physician and for four weeks will experience the practice of medicine in an ambulatory setting.

**2nd Year**

| | | |
|---|---|---|
| **Step 6** | The Life Cycle ( Reproduction, Embryology and Genetics) | 4 weeks |
| **Step 7** | Invasion and Defense (General Pathology, Microbiology, Immunology) | 10 weeks |
| **Step 8** | Pathophysiology and Advanced Problem Solving | 20 weeks |

II. **Problem-Based Tutorial Sessions**, where small groups of 5 to 6 students discuss and analyze in a metacognitive way a weekly medical case problem with a faculty **Tutor** and set the necessary agenda of learning issues for self-directed study.

**Follow-up sessions** in which the students refine and synthesize the learned information and, if needed through additional discussion and interaction, set new, advanced learning issues.

The medical problems are presented in a case study format designed to reflect the step and the weekly themes.

III. Basic science **laboratories** in which the medical students participate in hands-on activities and through additional group discussion and problem solving supplement the tutorials and be able to test certain hypotheses.

IV. A minimum of basic **lectures** designed to supplement each step's content with the problem-based sessions, presented by Center faculty, introduce key concepts and guide and orient the medical students to the ppropriate learning objectives.

V. **The Doctor/Patient Interaction** are presented every Monday afternoon, from 1 to 3 p.m. The **freshman** and **sophomore** medical students earn the art of history taking and physical diagnosis from experienced preceptors. Initially the **freshman** medical students are exposed to a series of clinical experiences in which they learn from patients about the impact of illness on their lives and what they expect from their physicians. Experienced faculty preceptors train the students in the fundamentals of patient interviewing.

The **sophomore** medical students learn from experienced faculty preceptors: (a) how to perform a medical interview; (b) the necessary skills for physical examination and the contents of general screening physical examination, including the elementary physical diagnosis; (c) what are the normal physical findings; and (d) how to integrate data diagnostic collection.

VI. Another afternoon, from 1 to 3 p.m., **Special Topics** are presented, such as behavioral sciences, medical ethics, socio-economic issues, emergency medicine and biostatistics. These sessions are designed in a problem-solving format and behavioral, ethical, socio-economic and statistical issues presented in weekly cases will be discussed and analyzed extensively.

In the area of **emergency medicine** the students learn by being the shadows of practicing emergency medicine physicians. This format has proved to be a successful learning experience for the Northwest Center freshman medical students.

VII. Medical students are welcome to participate in the individual faculty research programs currently available at the Northwest Center. Interested students can arrange this participation with individual faculty members at the Center. Also medical students may be selected by the Honors in Academic Medicine Committee of the Indiana University School of Medicine to do independent research with a faculty at the Northwest Center.

Medical students are encouraged to attend: (a) the weekly series of seminars in basic sciences and in clinical research; (b) the visiting professor lecture hour series presented by guest lecturers for sophomore and senior medical students, residents, and other advanced-level students; (c) the distinguished lectureship; (d) the Director's Hour series which covers areas in medical ethics; (e) the continuing medical education (CME) programs for practicing physicians; and (f) a large number of other medical educational activities that are offered by the local hospitals.

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